

In the Office Action, Claims 1-19 were rejected under 35 U.S.C. §103(a), as being unpatentable over Murakami et al. (U.S. Patent No. 5,030,017) alone or in view of EPO 592 195. Applicants respectfully disagree with the Examiner as discussed further below.

As claimed in amended independent Claims 1, 6 and 7 of the present Application, the present invention relates to an anti-friction bearing for a rotary support section of a computer peripheral device wherein at least one bearing component is made of martensitic stainless steel composed of 0.60 to 0.75 % by weight carbon, 10.5 to 13.5 % by weight chromium, 1.0 % by weight or less silicon, 0.3 to 0.8 % by weight manganese, the remainder of the composition being iron and inevitably introduced impurities, containing eutectic carbide particles of 10  $\mu\text{m}$  or less in diameter, having titanium and oxygen concentrations of 10 ppm or less respectively, having a hardness of HRC 58 or higher, and having more than 0% and less than 10 % by volume retained austenite.

In the Office Action, the Examiner indicated that with respect to claims 1, 6, and 7, Murakami discloses a rolling bearing comprising a steel alloy consisting essentially of carbon, chromium, silicon, manganese, oxygen, titanium and balance iron in ranges which overlap the claimed ranges. The Examiner indicated, however, that Murakami does not disclose the claimed range of retained austenite (i.e., less than 10% by volume of retained austenite). Instead, Murakami discloses a range of 10-25% by volume of retained austenite. The Examiner, however, believes that the ranges are "close enough so that one of ordinary skill in the art at the time of the invention was made would have expected these steels to have the same properties."

In accordance with the Manual of Patent Examining Procedure ("MPEP"), to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally

available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. See MPEP §2143. Where the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In accordance with the disclosure of the Murakami reference, the object of its invention is to improve the longevity of rolling bearings used in transmissions and engines. See e.g., column 2, lines 1-3. To achieve this object, Murakami provides a rolling bearing including races and a rolling element, characterized in that at least one of the races and the rolling element is made of an alloy steel, which is then carburized or carbonitrided, a content of fine carbide in the surface layer of one of the races and rolling element is 20-50 % by volume and the content of retained austenite in the surface layer is 10-25 % by volume. See e.g., column 2, lines 6-13. The disclosure further indicates that if the level of retained austenite is below 10 % by volume, the longevity of the rolling bearing is decreased (column 6, lines 28-31). Therefore, in order to achieve the specified object of the Murakami invention, the content of the retained austenite in the surface layer has to be kept 10-25 vol %. (See *id.*). Thus, the modification proposed by the Examiner would render the prior art unsatisfactory for its intended purpose.

Moreover, Murakami does not disclose an anti-friction bearing for a rotary support section of a computer peripheral device. Instead, Murakami discloses ball bearings for use in automobiles which are typically larger in size than bearings for computer devices. More importantly, bearings used in automobiles do not require reduction in noise during their operation. Computer peripheral devices, by contrast, have a low noise requirement of operation.

As can be seen from the Murakami patent, it has been assigned to NSK Ltd. Applicants have obtained the smallest available NSK bearings used in automobiles and measured their level of retained austenite. After the level of retained austenite was measured, Applicants measured Anderon value (a noise indicator) of NSK bearings. Each of the obtained bearings was tested using a Sugawara Anderometer test unit. The obtained bearings were greased bearings with seals installed on both sides. Tests were performed with both seals removed but with grease left in place. No degreasing was performed. The bearings were rotated at 1800rpm, with a gage load of 1.2Kgf (2.6 lbs.f) applied. The inner ring was rotated at the prescribed speed, with the outer ring held stationary. A probe measured the vibration (noise) on the outer ring. The results were recorded for the high, medium and low bands, as shown in Table I. The high band is defined as a range of 1800 – 10,000 HZ, medium band as 300 – 1800 HZ and low band as 50 – 300 HZ.

**Table I**

<b>Anderometer Testing</b>				
<b>Part Number</b>	<b>Sample No.</b>	<b>High Band</b>	<b>Medium Band</b>	<b>Low Band</b>
		<b>Side 1/Side 2</b>	<b>Side 1/Side 2</b>	<b>Side 1/Side 2</b>
6202VVCM NS7S	1	<b>2.1 / 2.3</b>	<b>0.6 / 0.55</b>	<b>0.45 / 0.40</b>
	2	<b>2.6 / 2.45</b>	<b>0.65 / 0.65</b>	<b>0.45 / 0.45</b>
	3	<b>1.2 / 1.8</b>	<b>0.65 / 0.65</b>	<b>0.40 / 0.40</b>
6002VVCM NS7S	1	<b>0.9 / 0.8</b>	<b>0.5 / 0/4</b>	<b>0.35 / 0.35</b>
	2	<b>1.1 / 0.8</b>	<b>0.4 / 0.4</b>	<b>0.35 / 0.32</b>
	3	<b>0.8 / 0.9</b>	<b>0.45 / 0.45</b>	<b>0.37 / 0.37</b>
6201VVCM NS7S	1	<b>0.9 / 0.9</b>	<b>0.55 / 0.55</b>	<b>0.4 / 0.45</b>
	2	<b>0.9 / 0.8</b>	<b>0.75 / 0.70</b>	<b>0.38 / 0.4</b>

	3	1.6 / 1.2	0.85 / 0.70	0.4 / 0.38
6001VVCM NS7S	1	1.0 / 1.4	0.9 / 1.1	0.6 / 0.55
	2	1.2 / 1.3	1.0 / 1.2	0.5 / 0.5
	3	1.5 / 1.6	0.9 / 0.8	0.55 / 0.55
6203VVCM NS7S	1	1.2 / 1.4	1.1 / 1.2	0.7 / 0.9
	2	1.2 / 1.4	0.8 / 0.75	0.65 / 0.6
	3	2.0 / 1.8	0.7 / 1.0	0.55 / 0.65

Retained austenite testing was accomplished on components from each of the sample bearings submitted. Tests were performed on each inner and outer ring. A representative ball was tested for two of the three samples of each part number. One sample was retained as a fully assembled bearing and as such no access to a ball was possible for these bearings. The retained austenite was determined using X-ray diffraction with Chromium K-alpha radiation. The ranges over which the diffraction spectrum was collected were 2-theata angles of 146 to 165 degrees for the martensite peak and 126 to 135 for the austenite peak. The per cent volume of retained austenite results are as reported in Table 2.

Table II

<b>Retained Austenite Testing</b>				
<b>Part Number</b>	<b>Sample No.</b>	<b>Component</b>		
		<b>Inner</b>	<b>Outer</b>	<b>Ball</b>
6202VVCM NS7S	1	10.4%	25.7%	7.4%
	File No.	Z04348	Z04349	Z04354
	2	16.0%	16.2%	6.7%
	File No.	Z04362	Z04363	Z04364

	3	8.1%	18.8%	n/a
	File No.	Z04365	Z04370	n/a
6002VVCM NS7S	1	4.5%	21.1%	4.6%
	File No.	Z04371	Z04372	Z04373
	2	14.9%	26.7%	7.1%
	File No.	Z04374	Z04375	Z04376
	3	4.1%	18.0%	n/a
	File No.	Z04378	Z04377	n/a
6201VVCM NS7S	1	14.9%	22.2%	6.7%
	File No.	Z04379	Z04380	Z04390
	2	12.6%	16.3%	11.1%
	File No.	Z04332	Z04333	Z04396
	3	7.9%	31.1%	n/a
	File No.	Z04334	Z04335	n/a
6001VVCM NS7S	1	8.2%	18.2%	5.0%
	File No.	Z04336	Z04337	Z04397
	2	9.5%	11.8%	7.8%
	File No.	Z04338	Z04339	Z04398
	3	4.5%	25.5%	n/a
	File No.	Z04340	Z04341	n/a
6203VVCM NS7S	1	16.9%	13.6%	6.3%
	File No.	Z04401	Z04400	Z04399
	2	14.5%	22.3%	4.7%
	File No.	Z04402	Z04403	Z04404
	3	15.1%	3.8%	n/a
	File No.	Z04342	Z04343	n/a

Samples of each bearing were sent to a NADCAP accredited laboratory, Laboratory Testing Inc., Hatfield, PA for analysis of the titanium and oxygen content. The oxygen testing was accomplished using inert gas fusion infrared detection and the titanium using

inductively coupled plasma (ICP) atomic emission spectrometry. The results are reported in Table 3.

**Table III**

<b>Titanium - Oxygen Testing</b>				
Part Number	Sample No.	Component	Oxygen	Titanium
			%	%
6202VVCM NS7S	1	Inner	0.002	0.0041
		Outer	0.0026	0.0027
		Ball	0.0002	0.0031
	2	Inner	0.0023	0.0029
		Outer	0.0017	0.0030
		Ball	0.0001	0.0046
6002VVCM NS7S	1	Inner	0.0024	0.0061
		Outer	0.0022	0.0053
		Ball	0.0003	0.0033
	2	Inner	0.0017	0.0044
		Outer	0.0020	0.0074
		Ball	0.0006	0.0037
6201VVCM NS7S	1	Inner	0.0026	0.0027
		Outer	0.0015	0.0052
		Ball	0.0002	0.0040
	2	Inner	0.0023	0.0039
		Outer	0.0027	0.0054
		Ball	0.0004	0.0052
6001VVCM NS7S	1	Inner	0.0026	0.0031
		Outer	0.0024	0.0043
		Ball	0.0002	0.0034
	2	Inner	0.0033	0.0034
		Outer	0.0022	0.0042
		Ball	0.0006	0.002

6203VVCM NS7S	1	Inner	0.0014	0.0029
		Outer	0.0024	0.0043
		Ball	0.0004	0.0039
	2	Inner	0.0018	0.0044
		Outer	0.0019	0.0044
		Ball	0.0005	0.0052
		PPM = % X 10,000		

Based on the above data, it can be seen that at least three samples (i.e.,

6202VVCM NS7S- sample no. 2; 6201VVCM NS7S – sample no. 1; and 6203VVCM NS7S – sample no. 1) correspond to bearings disclosed in Murakami.

The above results can be compared to Anderon values for a bearing constructed in accordance with the presently claimed invention, as shown in Table 4.

**Table IV**

	Anderon Value	
	M	H
Stainless Steel Bearing According to the Invention	0.270	0.200

Anderon values for the bearings constructed in accordance with the presently claimed invention are better than Anderon values for the three NSK bearings compatible with the bearings disclosed in Murakami.

Based on the above, claims 1, 6 and 7 are patentable over the Murakami reference because this reference can not be modified to meet the limitation of " having more than 0% and less than 10 % by volume retained austenite." Applicants respectfully submit that dependent

claims 2-5 and 8-17 are likewise believed to define patentable subject matter in view of their dependency upon allowable claims 1, 6 and 7 and, further, on their own merits.

Moreover, none of the other references cited by the Examiner discloses the limitation of " having more than 0% and less than 10 % by volume retained austenite," as is required by the presently claimed invention.

The Examiner further rejected claims 1-19 under 35 U.S.C. 103(a) as being unpatentable over Obara et al (U.S. Patent No.5,843,369) which discloses a stainless steel for an antifriction bearing which overlaps component ranges of the claimed bearing, except for the retained austenite range which is not taught by the Obara '369 reference. Applicants amended independent claims of the Application to recite the range of retained austenite greater than 0%. The '369 reference does not teach the currently recited range of retained austenite, therefore this limitation is not met by this reference.

Thus, claims 1, 6, and 7 are believed to be patentable over the cited prior art. Applicants respectfully submit that dependent claims 2-5 and 8-17 are likewise believed to define patentable subject matter in view of their dependency upon allowable claims 1, 6 and 7 and, further, on their own merits.

Claims 1-19 were further rejected under the obviousness-type double patenting doctrine as being unpatentable over claims 1-10 of the Obara '369 reference. As indicated above, claims 1-9 and 12-17, as amended, are not obvious and are patentable over the Obara '369 reference. Therefore, the double patenting rejection should be withdrawn.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version With Markings to Show Changes Made."

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It is respectfully submitted that claims 1-9 and 12-17, as presented, patentably define over the prior art of record. Accordingly, this Application is believed to be in a condition for allowance. Prompt and favorable action is earnestly solicited and believed to be fully warranted.

Respectfully submitted,

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE CLAIMS:**

Please amend claims 1, 6, and 7 as follows:

1. (amended) An anti-friction bearing for a rotary support section of a computer peripheral device wherein at least one component is made of martensitic stainless steel composed of 0.60 to 0.75 % by weight carbon, 10.5 to 13.5 % by weight chromium, 1.0 % by weight or less silicon, 0.3 to 0.8 % by weight manganese, the remainder of the composition being iron and inevitably introduced impurities, containing eutectic carbide particles of 10  $\mu\text{m}$  or less in diameter, having titanium and oxygen concentrations of 10 ppm or less respectively, having a hardness of HRC 58 or higher, and having more than 0% and less than 10 % by volume retained austenite.

6. (amended) An anti-friction bearing for a rotary support section of a computer peripheral device comprising a plurality of rolling elements provided in raceway grooves formed in an inner and an outer ring; said anti-friction bearing characterized in that at least one of said inner ring and outer ring are made of martensitic stainless steel composed of 0.60 to 0.75 % by weight carbon, 10.5 to 13.5 % by weight chromium, 1.0 % by weight or less silicon, 0.3 to 0.8 % by weight manganese, the remainder of the composition being iron and inevitably introduced impurities, containing eutectic carbide particles of 10  $\mu\text{m}$  or less in diameter, having titanium and oxygen concentrations of 10 ppm or less respectively, having a hardness of HRC 58 or higher, and having more than 0% and less than 10 % by volume retained austenite.

7. (amended) An anti-friction bearing for a rotary support section of a computer peripheral device comprising a plurality of rolling elements provided in raceway grooves formed in an inner and an outer ring; said anti-friction bearing having a stepped shaft having a larger diameter section and a smaller diameter section and a cylindrical outer ring, wherein an inner ring is fitted to said small diameter section, a pair of outer ring raceway grooves being formed on the inner peripheral surface of said cylindrical outer ring, inner ring raceway grooves formed respectively on the outer peripheral surface of said larger diameter section and on the outer peripheral section of said inner ring, said anti-friction bearing characterized in that said inner ring and outer ring and shaft are made of martensitic stainless steel composed of 0.60 to 0.75 % by weight carbon, 10.5 to 13.5 % by weight chromium, 1.0 % by weight or less silicon, 0.3 to 0.8 % by weight manganese, the remainder of the composition being iron and inevitably introduced impurities, containing eutectic carbide particles of 10  $\mu\text{m}$  or less in diameter, having titanium and oxygen concentrations of 10 ppm or less respectively, having a hardness of HRC 58 or higher, and having more than 0% and less than 10 % by volume retained austenite.